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ABSTRACT

This paper presents elements of the computer graphics environment including information on: Lotus 1-2-3; Apple Macintosh; Desktop Publishing; Object-Oriented Programming; and Microsoft's Windows 3. A brief scenario illustrates the use of the minimization principle in presenting a new product to a group of international financiers. A taxonomy of four basic classes of graphics applications contains: (1) Analytical Graphics--the largest and most important use of computer graphics in business and science including tables, charts, and graphs; (2) Presentation Graphics--used to support a premise or argument, more colorful, text-oriented and elegant than analytical graphic devices; (3) Illustrative Graphics--designed to clarify an idea or concept, instructional and informational, portrays objects realistically; and (4) Story Graphics--used to make the entire presentation with no text or documentation, flexibility is key. The application of the minimization principle and the taxonomy of graphics to graphic design is used in order to improve information transfer in international settings; increase the focus of presentations; and achieve language independence in presentations. (Contains 18 references.) (ALF)

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# IDEAS WITHOUT WORDS -- INTERNATIONALIZING BUSINESS PRESENTATIONS

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## COMPUTER GRAPHICS ENVIRONMENT

### The Computer as a Symbol Processor

The traditional concept of a computer as a "data processor" or "number cruncher" - a machine designed to perform calculations - has given a whole generation of business professionals the wrong impression of the power and potential of business computer systems.

In fact, the computer is actually a symbol processor - a device designed to manipulate symbols. Symbols can represent a wide variety of objects in addition to numbers. Among them are such items as characters, words, documents, icons, and images.

The input, processing, and output operations depend on the semantics of the objects represented by the symbols. Since these operations were already well understood for numbers, numbers became the primary symbols for computer manipulation in the early days of computerization.

In the initial stages, input and output devices for most computer systems were limited to alphanumeric keyboards and character-oriented printers. Computer languages and software were also numerically-oriented. This resulted in the idea of the computer as a "super calculator."

### Lotus 1-2-3

The electronic spreadsheet was in widespread use in business before the IBM PC was even announced. However, a brilliant implementation for the PC, titled 1-2-3 (by Lotus Development Corporation), integrated graphics capabilities. With the availability of a popular and effective graphics software package, a market for add-on graphics hardware was established.

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Soon, a number of third-party vendors began supplying improved graphics adapter cards and monitors for the IBM PC. One card, the Hercules monochrome graphics card, became a de facto standard for the industry. This card allowed high-resolution graphic displays on the monochrome monitor. Soon, many other vendors were offering low-priced monochrome graphics cards that replicated its functions.

## The Apple Macintosh

While IBM dominated the business market with alphanumeric-oriented personal computer systems, Apple Computer embarked on a radically different departure. First an expensive, graphically-oriented, integrated system called the LISA was introduced. However, high costs, and the radically new ideas behind the system, caused the business community to reject the LISA.

The Apple Macintosh was introduced in 1984. Less expensive than the LISA, it focused on ease of use and computer graphics. The Macintosh graphical interface, derived from work at XEROX PARC Laboratories, utilized icons to represent computer functions and programs, and a mouse pointing device to reduce the need for keyboarding.

The business community first greeted the Macintosh with some skepticism, engendered in part by its small, monochrome screen, limited keyboard, lack of sophisticated business applications software, and LISA heritage. But its growing body of software, simplicity, and ease of use, together with the elegance of its graphic interface eventually won over the opposition.

## Desktop Publishing

Two other high-impact developments -- namely low-cost laser printers and powerful page layout software -- fundamentally altered the graphics marketplace. In a short time, a new, multi-billion dollar industry called "desktop publishing" was firmly established.

In the most general sense, publishing consists of gathering information, refining it through the editing process, adding illustrations, and presenting it in an aesthetically pleasing form. When personal computers, laser printers, and page layout software are used, the operation is characterized as desktop publishing, as opposed to the conventional typesetting-engraving venue.

## Object-Oriented Programming

In addition to hardware and applications developments, there were some very significant theoretical developments in computer graphics programming as well. The most important was the emergence of object-oriented programming.

Smalltalk-80, developed by Goldberg and Robson at Xerox PARC, pioneered object-oriented programming (OOP). Smalltalk featured window managers, icons, mice, and pop-up menus (known collectively as WIMPs), which created a new computational environment for graphics. The user model was a desk top, covered by various sheets of paper, and an assortment of tools. The WIMPs concept laid the groundwork for Apple LISA, and eventually led to the commercially successful Macintosh.

Windows 3

The latest development in personal computer graphics is Windows 3, introduced by Microsoft in May of 1990. During its first year, Windows 3 sold more than 6,000,000 copies, making it one of the most successful software packages ever produced. Windows 3 is a graphical environment for personal computers that uses the Intel 286, 386, and 486 family of processors. Working in conjunction with Microsoft's PC-DOS and MS-DOS operating systems, Windows 3 features a graphical user interface (GUI) and multiple-applications support. Windows 3 is a single product that merges versions of Windows originally designed for different processors.

The Intel 286 has been around since 1984. It is the standard processor for the millions of IBM PC/ATs and AT clones. The newer 386 is the standard processor for the high end PS/2s, Compacs, and most of the modern clones. Computers using the 386 processor now top the list of the fastest selling systems. Only the most powerful personal computers use the 486 processor.

However, Intel has announced that low-cost versions of this "super chip" will soon be available. Estimates call for Windows 3 to operate on an installed base of over 25 million computer systems.

When Windows 3 was introduced, more than 300 windows applications were announced along with it. Since then, hundreds of other applications have either been ported to Windows or developed for the environment. Of particular importance, is the fact that the mainstay Macintosh applications are now available for Windows 3.

## COMPUTER GRAPHICS APPLICATIONS

A ubiquitous graphics environment, plus outstanding graphics software, offer the business communicator a wide variety of choices in preparing documents and presentations. In fact, there are so many packages available that it is difficult to decide which package is best for a particular situation.

The first step in evaluating graphics software for business communications is to develop a rational classification system for graphics applications. This allows the user to make

appropriate comparisons, and to analyze different graphics software packages on a logical and consistent basis.

## Classification of Graphics Applications

In this paper, four basic classes of graphics applications are used. They are:

1. Analytical Graphics
2. Presentation Graphics
3. Illustrative Graphics
4. Story Graphics

## Analytical Graphics

Analytical graphics was one of the very first graphics applications areas, and it continues to represent one of the largest and most important uses of computer graphics in both business and science. The objective of analytical graphics is to detect trends and relationships among numeric data. Spreadsheet packages, such as Lotus 1-2-3, Quattro Pro, EXCEL, and SuperCalc, are the most frequently-used software for analytical graphics. But most general graphics software packages, such as Harvard Graphics, also support analytical graphics.

The principal analytical graphic devices are bar and pie charts, line and X-Y graphs, and area charts. With the bar chart, the X-axis normally represents time, while the Y-axis represents the magnitude of the variable being graphed. Depending upon the software, up to six different variables can be displayed on the same bar chart.

In a regular bar chart, if more than one variable is charted, the bars representing each variable for each time period are placed side-by-side. In a stacked bar chart, a single bar composed of contributions from each variable is used for each time period. Bar charts, the most common form of business graphics, are used to show trends in data.

Pie charts are round, segmented charts. Each segment of the pie is proportional to the contribution of one of the variables to the total value. The pie chart does not use the axis concept. Pie charts are also quite common in business. They are the most effective method to show proportions of the whole.

Line and X-Y graphs are similar, but the line graph is much more common in business applications. The line graph shows the value of a variable on the Y-axis, versus time on the X-axis.

With the X-Y graph, two variables are plotted against each other, with the value of one variable representing the ordinate of the point, and the value of the other representing

the abscissa of the point. Line graphs are used to show both trends and relationships of data.

Normally, up to six different variables can be displayed on the same line graph. However, care must be taken to distinguish between them. If more than three variables are displayed on the same line graph, there is apt to be some confusion, particularly when there is crowding. The X-Y graph is more popular in scientific applications than in business.

Area charts place the data in selected regions of the graph, depending upon functional discrimination or relational mapping criteria. These charts are used to partition data into various equivalence classes for systematic analysis.

Each of these analytical graphics devices can be represented in both two and three dimensional forms, and most sophisticated software packages support both 2D and 3D data displays, where appropriate.

Presentation Graphics

Presentation graphics are those graphics used to support a premise or argument, or to make a case for a particular course of action. They are normally more colorful, text-oriented, and elegant than analytical graphic devices.

Most graphic software combines analytical and presentation facilities in the same package, since analytical graphics serve as the foundation for many presentation graphics. In addition, most modern graphics packages allow the user to import graphics or data from standard spreadsheet packages. Harvard Graphics is the leading presentation graphics package. However, Microsoft's PowerPoint and Cricket Presents are considered two of the better presentation graphics packages.

Presentation graphics output is often needed for projection; that is, in the form of 35MM slides or overhead transparencies.

Illustrative Graphics

Illustrative graphics are designed to clarify an idea or a concept. They can be both instructional and informational as well. They differ from presentation graphics in that they are meant to be literal and realistic in their portrayal of objects. Paint and drawing programs are the basic software support for illustrative graphics. Many of these programs have extensive "clip art" libraries of stock figures and drawings to aid the non-artist.

Paint programs use color and bit-mapping technology. In bit-mapping, the display is stored as a series of encoded numbers, one for each picture element or pixel of the image. Drawing software, on the other hand, is used to produce exact images.

Drawing software relies on vectors or mathematical descriptions of the image. This frees the image from the accuracy constraints of a computer screen, and allows output displays of unusual clarity and sharpness, limited only by the resolution capability of the hardcopy device. Corel Draw, DrawPerfect, Gem Artline, and Arts and Letters are generally considered to be the top PC and Windows drawing packages. MacDraw and Adobe Illustrator are two of the leading Apple packages.

Maps and CAD/CAM represent two other important categories of illustrative graphics. Generating accurate maps is a standard computer graphics application. Topographical data can be used to create contour maps. Similarly, various other types of data can be superimposed on maps to produce weather maps, resource maps, and the like. CAD/CAM drawings are done to scale in high resolution, and outputed with careful registration. They are often annotated and dimensioned, using special symbols.

Another important area of illustrative graphics, involves showing complex relationships or sequences of steps, through flow charts, system charts, organizational charts, Gannt charts, and network diagrams.

These illustrative graphics devices are composed of special sets of symbols, drawn in an inter-related pattern. The usual approach with flow charts, system charts, and organization charts is to use specialized symbols, labelled with text and connected by arrowed flow lines, to indicate the direction of flow.

Gannt charts, on the other hand, use stacked bars of varying lengths to indicate the relationship and duration of various tasks. Network diagrams show complex interdependencies of tasks, steps, or processes. They are composed of "nodes" connected by "arcs." The nodes are often simply circles containing text labels. The arcs are either straight or curved lines connecting the nodes. The arcs are sometimes arrowed to show the direction of flow through the network.

Story graphics

The last category is story graphics. Here, the graphics are used to make the entire presentation, with no intermediate text or documentation. Slide shows, animation, comic strips, and story boards are typical examples of story graphics.

A key feature of story graphics is flexibility. With story graphics, the business communicator can bypass the real-world and physical constraints on images, actions, and color mixtures.

## LANGUAGE DEPENDENCE OF GRAPHIC DEVICES

The above taxonomy allows us to analyze the various classifications for language dependence.

1. Analytical Graphics -- Analytical graphics are the most universal of all graphic devices. Students throughout the world have been taught to use analytical graphics for data analysis. In most cases, only the titles need be changed to handle any translation process, and often, even an English title can be understood by most business persons.

2. Presentation Graphics -- The word chart is one of the leading devices in presentation graphics. This is because word charts are relatively easy to create. Obviously, word charts are particularly language dependent.

However, by pre-planning and utilizing the improved graphics environment, you can create charts and graphs with more elaborate imaging and pictographs. This allows presentation graphic devices to use symbolic representations of real objects, selected specifically to convey psycological and moral values.

The objective is to persuade the reader or viewer that the position taken in the presentation is correct and morally appropriate. Therefore, effective presentation graphics packages should include symbol libraries to allow the user a variety of options for selecting the appropriate representation. For this reason, the ability to use color can be an important factor in presentation graphics.

3. Illustrative Graphics -- The instructional and informational nature of illustrative graphics, and the availability of clip art libraries, allows a great deal of language independence. Maps and CAD/CAM are especially universal, as are flow charts, system charts, organization charts, Gannt charts, and network diagrams.

4. Story Graphics -- Slide shows, animation, comic strips, and story boards have the potential for a high degree of language independence. However, this goal must be incorporated in the planning for the story graphics application.

In summary, the very nature of graphics allows for potential language independence. However, including language independence as a design goal when developing graphic devices ensures that your presentations will achieve their full potential.

Building Language Independence into Graphic Devices

The single most important principle in achieving language independence with graphic devices is the minimization principle. To apply this principle, determine the minimum task that the graphic device must accomplish. Then design your graphic to perform that task -- and no more.

The biggest problem with novice graphic designers is that they try to do too much with one device. Adhering to the minimization principle will focus and sharpen your graphic devices and reduce language dependence.

Applying the minimization principle requires the following six step process:

1. Prepare a list of objectives for each graphic.

2. Review these objectives by establishing exactly what you want your audience to know or believe as a result of viewing your graphic.

3. Select the graphic device and images to achieve these objectives. Think of analytical, illustrative, and story graphics, not text charts. Use icons and images, not words; that is, do not include any text unless it is absolutely necessary. More is less in this case.

4. Execute the graphic, using the appropriate computer software.

5. Analyze the graphic, using the basic graphic design criteria of simplicity, unity, emphasis, and balance. Be sure that the text is minimized.

6. Revise the graphic, if needed.

**APPLYING THE MINIMIZATION PRINCIPLE**

The following brief scenario and example will serve to illustrate the minimization principle.

> A corporate executive is presenting a new product to a group of international financiers. The executive wants the presentation to be as language independent as possible. The presentation must illustrate product attributes, costs, and economics.

If the executive took the traditional approach to preparing the presentation, the bulk of the graphics would have been text charts. However, with the minimization principle, the basic graphic devices are developed through the use of analytical, illustrative, and story

graphics. Specifically, drawings are used to produce the description, and bar, pie, and line charts are used to illustrate the cost and sales forecasts for the product. The cost and economics charts would be derived from spreadsheet tables and graphs.

Producing the Graphic

The preliminary graphic should be created on the monitor screen in draft form. Then it is adjusted, modified, and refined, until a suitable and consistent format is established for the entire set of graphic devices in the message.

Once the proper format, structure, and content are established, you can decide on the software and output media for the final version.

For example, a spreadsheet program would be appropriate for the preliminary determination of whether a bar or line chart is the better way of analyzing the data described in this scenario. However, for the final chart, Harvard Graphics might be used to take advantage of improved facilities. A laser printer, plotter, color printer, or slide generator could be used for output, depending upon the results of the design step.

Review and Revisions

Once the entire set of graphics is produced, the presentation should be reviewed and tested. If possible, have a "representative" of the viewing audience review the graphics and ask some questions about the message content and acceptability. This will supply the necessary feedback to ensure that the objectives were actually achieved with your graphics, and that the fine points are clear.

If is not possible to get an audience representative, try to separate yourself from the project for some time before you conduct the review. That is, let your emotional involvement with the project cool down. This should allow you to see the graphics from a "fresh viewpoint." It will also make any inconsistencies, ambiguities, or ommissions more obvious. Depending upon the results, make the necessary corrections and repeat the testing process.

## CONCLUSIONS

By applying simple design principles, and paying close attention to detail, the international business communicator can produce a variety of graphic devices that are essentially language independent. Analytical, illustrative, and story graphic devices, supported by icons and images rather than text, will not only improve information transfer in international settings, they will increase the focus and ultimately sharpen your presentations.

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